REMARKS

This Amendment, in connection with the following remarks, is submitted as fully responsive to the Office Action. Claims 13-16 and 18 have been amended, and new claims 27-28 have been added. No new matter has been added. Claims 13 and 28 are the independent claims. Favorable reconsideration is requested.

Claims 13-26 stand rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. Claims 13-26 stand rejected under 35 U.S.C. §102(b) as being anticipated by Lin et al., *Neural Fuzzy Systems*, 1996 ("Lin").

The present invention is directed to an improved artificial neural network having an input layer and an output layer, and optionally one or more hidden layers. The input layer has a set of input nodes, and the output layer has a set of output nodes. At each output node two transformation steps are performed on the input data to that output layer (*i.e.*, the "input data" being the data input to said layer by the immediately previous layer). These two transformation steps are (A) a first transformation step that sums weighted input received from the input nodes, and (B) a second transformation step that transforms the result of (A) through a nonlinear function. *Specification* at [0009]. These are the standard transformations at each node of a classical neural network. *Id.*

In addition to such classical neural network nodal processing, a novel aspect of the invention is that said first transformation step (A) comprises **two** sub-steps: (i) a first sub-step being a nonlinear transformation function of the input data received by the output nodes from the input nodes and (ii) a second sub-step summing the non linearly transformed input data from the said first sub-step. *Specification* at [0019]. Thus, such a novel aspect adds a nonlinear

transformation pre-step prior to the classical neural network primary step of summing weighted inputs form the prior layer. *Id.*

Thus, in the claimed invention, at each output node there is an (A) step and a (B) step, where the (A) step comprises two sub-steps, (i) and (ii). Step (A)(i) is a first nonlinear transformation of the input data, step (A)(ii) is a weighted summing of the output of (A)(i), and following that, step (B) is second nonlinear transformation of the results of step (A).

Thus, given the novel aspect of step (A)(i), in the claimed invention two nonlinear transformations occur at each output node, one <u>prior to the summing of weighted inputs</u> from the prior layer (= step (A)(i)), and one <u>after said summing</u> (= step (B)). Therefore, for example, if a neural network according to the claimed invention has one input layer and one output layer, as recited in claim 13, two nonlinear transformations of data occur. On the other hand, for example, if a neural network according to the claimed invention has one input layer and one output layer and N hidden layers, as is recited, for example, in claim 14, then 2(N+1) nonlinear transformations occur, <u>two</u> at each of the N+1 hidden or output layers.

This double nonlinear transformation at each output layer (whether at the "ultimate" output layer or whether at an intermediate hidden layer) aspect of the claimed invention has the aim of improving an artificial neural network in such a way as to have better, more reliable and faster convergence of the algorithm to the best solution and avoiding also local minima during learning phase. *Specification* at [0018].

Applicant will first address the non-statutory subject matter rejections, and then the substantive prior art rejections.

I. 35 U.S.C. §101 Rejections

Claim 13 has been amended to recite that the claimed neural network is implemented in a computer having a processor and memory and that the output data is provided to a user. Thus, Applicant submits, the claimed neural network is directed to a novel processing structure implemented in a real world device, a computer. Such a device allows a user to have better, more reliable and faster convergence of the algorithm to the best solution and avoiding also local minima during a learning phase. The claimed neural network can take as input a set of data from a database, such as, for example, an input vector, and output a nonlinear transformation of a nonlinear transformation of said input data. The output data can then be provided to a user, such as, for example, via a display or a file, or both.

Given these amendments, Applicants respectfully request that the 35 U.S.C. §101 Rejections be removed. The claimed computer implemented neural network is not an abstract algorithm, but rather a tangible computational structure. As such, claim 13 does not violate the doctrine of preemption. An abstract algorithm is not claimed. A specific computational structure implemented in a computer is. Such computational structures implemented in computers are well known, and highly useful for a variety of computational tasks. Such structures can be seen as specialized computational systems implemented in software.

In this context, Applicants note that the U.S. Patent Office has issued numerous patents claiming neural networks implemented in computers. For example, U.S. Patent No. 7,092,857 claims:

> 1. A neural network for computer-aided knowledge management, with the neural network being composed of elements which are related to one another and are weighted, and which network is stored computationally as an associative data structure dynamically in the memory area of a computer, and the individual elements are allocated a significance content, characterized in that each element is allocated a definition of a development as the significance content, or directly contains this, in that this definition forms a subset in the form of an interaction pair which, optionally in the form<quantity|quality> via its verbal definition, defines the development and hence

accurately defines the knowledge set, which maps the quantity onto the quality, and the quality onto the quantity, and in that the elements form a Hilbert space.

Another example is U.S. Patent No. 7,080,053, which also claims a computer-implemented neural network:

> 1. A computer-implemented method for evolving appropriate connections among units in a neural network comprising the steps of: a) calculating weight changes at each existing connection and incipient connections between units for each training example; b) determining a K ratio using the weight changes, wherein said K ratio comprises ##EQU00002## and wherein if the K ratio exceeds a threshold, further comprising the steps of: b1) increasing a weight of the existing connection; b2) creating new connections at the incipient connections; and c) pruning weak connections between the units.

Finally, new dependent claim 27 further recites that the input data is from or related to a real world process, phenomenon or measurement. New claim 28 is a program storage device claim corresponding to claim 13.

II. 35 U.S.C. §102(b) Rejections

Turning now to the prior art rejections, the Examiner has rejected claims 13-26 as anticipated by Lin. Applicants respectfully traverse. Lin describes precisely the prior art conventional neural network referred to in the present Specification at [0009]. Fig. 10.7 of Lin is just such a classical neural network with an input layer (x_j), an output layer (y_i) and a hidden layer (z_q). At each of the hidden layer and the output layer a summing step and a nonlinear transformation step occur. The input layer takes inputs x_j and processes them with a weighting v_{qj}. At the hidden layer, after summing the weighted inputs $v_{qj}x_j$, *i.e.*, Sum{ $v_{qj}x_{j,}$} = net_q , as per Equation 10.24 -- a nonlinear transformation, z_q = a (net_q) = a [Sum{$v_{qj}x_j$}] is performed. The Examiner correctly reads nonlinear transformation “a” in z_q = a (net_q) of Equation 10.25 as

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being, for example, the transformation of Equation 10.45, which is one of the examples described in Lin.

Next, at the output layer y_i, proceeding in classical prior art neural network fashion, the inputs z_q to this output layer y_i, which are the outputs from the preceding hidden layer, are first summed using weights w_{iq}, via Sum{$w_{iq}z_q$}, and then operated on by nonlinear transformation "a" again, resulting in y_i = a (net_i) = a[Sum{$w_{iq}z_q$}] = a [Sum{w_{iq} a[Sum { $v_{qj}x_{j,}$}]}].

However, in Lin, at no output layer nodal processing is there a prior nonlinear transformation sub-step performed before the summing of inputs to that output layer. *I.e.*, at the nodal processing of the hidden layer, there is no nonlinear transformation prior to performing the step net_q = Sum{ $v_{qj}x_{j,}$}, and at the nodal processing of the output layer there is no nonlinear transformation prior to performing the summing step net_i = Sum{$w_{iq}z_q$}.

In the claimed invention there ***is*** such a pre-summing sub-step (*i.e.*, sub-step A(i)), <u>**in addition to the nonlinear processing *after* such summing**</u>, (*i.e.*, step B).

Thus, the claimed invention is submitted as patentable over Lin, and similarly, over all prior art classical artificial neural networks.

Applicant notes that the Examiner had to cite to the neural network of Fig. 10.7 of Lin to read on claim 13, because only by using the two nonlinear transformations of both the hidden layer z_q and the output layer y_i of Fig. 10.7 of Lin could one find the claimed two nonlinear transformations. However, the Fig. 10.7 of Lin is not analogous to the claimed neural network of claim 13, which recites the processing <u>solely at the input layer and the output layer</u>. The <u>output layer</u> recited in claim 13 performs two nonlinear transformations itself. Unlike that of Lin.

Claim 14 recites a neural network analogous to that of Lin's Fig. 10.7. In claim 14 <u>**four**</u> nonlinear transformations occur – two at the hidden layer, and two at the output layer,

completely distinct from Fig. 10.7 of Lin which has only two nonlinear transformations overall – only one at each of the hidden and output layers, unlike the claimed invention.

Thus, claim 13 is submitted as patentable over Lin. Dependent claims 14-27 are urged as patentable for similar reasons. New claim 28, a program storage device claim analogous to claim 13, is urged as also patentable for similar reasons.

Because the subject matter of the claimed invention is somewhat complex, Applicant welcomes the opportunity to discuss any issues relating to this Amendment and Response in a telephonic or personal interview. If the Examiner has any queries or needs any clarification, Applicants are more than happy to discuss the case at the Examiner's convenience in an effort ot advance prosecution.

No fee is believed to be due with the filing of this Amendment and Response. However, if any fee is due, the Director is hereby authorized to charge any additional deficiencies or credit any overpayments to Deposit Account No. 50-0540.

Respectfully submitted,

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